

## Chemical Reactions

1. Germanium has five naturally occurring isotopes with the following data

Mass (amu)	Percent (%) abundance
70	20
71	27
72	8
73	37
74	8

Use the information in the table to calculate the average atomic mass of Germanium. Show all calculations to receive full credit.

$$70 \times \frac{20}{100} = 14$$

$$71 \times \frac{27}{100} = 19.17$$

$$72 \times \frac{8}{100} = 5.76$$

$$73 \times \frac{37}{100} = 27.01$$

$$74 \times \frac{8}{100} = 5.92$$

$$\underline{\hspace{1.5cm}} \quad 71.86 \text{ u}$$

$$80 \times \frac{75\%}{100} = 60$$

$$60 \times \frac{25\%}{100} = 15$$

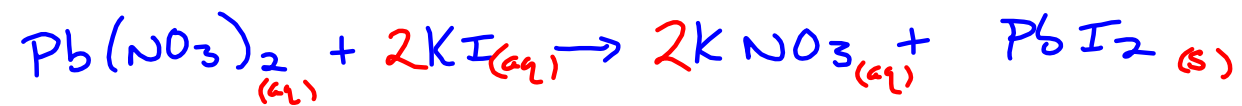
$$\underline{\hspace{1.5cm}} \quad 75$$

2. Aqueous Lead (II) nitrate is combined with aqueous potassium iodide in a double replacement reaction. A yellow solid is one of the products.

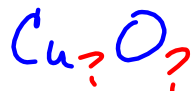
a) Identify the products formed.

Lead (II) iodide                      Potassium Nitrate

b) Write the balanced chemical equation, including state symbols.



## Chemical Reactions

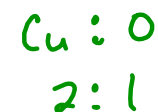


% to mass  
mass to moles  
÷ by small  
x till whole

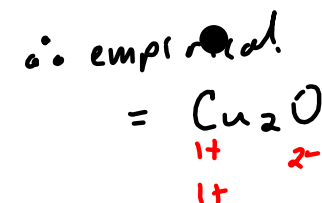
1. If 2.476 g of an oxide of copper is found to contain 2.199 g of copper, determine:

a) the empirical formula.

$$2.199 \text{ g Cu} \times \frac{1 \text{ mol}}{63.5 \text{ g}} = 0.0346 \text{ mol} \div 0.0173 = 2$$



$$2.476 - 2.199 \text{ g} = 0.277 \text{ g O} \times \frac{1 \text{ mol}}{16 \text{ g}} = 0.0173 \text{ mol} \div 0.0173 = 1$$



b) Copper (I) oxide

b) the name of the compound.

1. Use the following reaction used to obtain hydrogen gas from magnesium and hydrochloric acid:  $\text{Mg}_{(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{H}_{2(g)} + \text{MgCl}_{2(aq)}$

50 ml of 6 mol/L HCl is combined with 3 g of Mg to produce 2.45 L  $\text{H}_2$  gas.

a) Determine the limiting reactant.

$$0.05\text{L} \times \frac{6\text{ mol}}{1\text{L}} = 0.3\text{ mol HCl} \quad \text{← HAVE (excess)}$$

$$3\text{g} \times \frac{1\text{ mol}}{24.3\text{g}} = 0.123\text{ mol Mg}$$

$$0.123\text{ mol Mg} \times \frac{2\text{ mol HCl}}{1\text{ mol Mg}} = 0.246\text{ mol HCl} \quad \text{← NEED}$$

Need > have

$\therefore \text{Mg}$  is L.R.

b) Calculate the theoretical yield of hydrogen gas assuming STP Conditions.

$$0.123\text{ mol Mg} \times \frac{1\text{ mol H}_2}{1\text{ mol Mg}} = 0.123\text{ mol H}_2 \times \frac{22.4\text{ L}}{1\text{ mol}} = 2.76\text{ L}$$

c) Calculate the percent yield of  $\text{H}_2$ .

$$\% \text{ Yield} = \frac{\text{actual}}{\text{theoretical}} \times 100$$

$$= \frac{2.45\text{ L}}{2.76\text{ L}} \times 100 = 88.7\%$$

**Solutions**

1. Which of the following salts would be most effective for reducing icy road conditions? Explain why.



Answer: AlCl<sub>3</sub>

Explanation: -

- dissociates into the most ions (4) → more  
ions to interfere with crystal formation

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2. Explain why hot water has the ability to dissolve more salt (NaCl) compared to an equal volume of water that is at a much cooler temperature. A labeled diagram may be used to help with your explanation. (1 mark)

Hot water has more energy, more energy will allow more bonds to be broken b/w solute particles & solvent particles

## Solutions

3. Use the solubility curve in your data booklet for the next three questions.

- a. If a 200 ml saturated solution of sodium nitrate ( $\text{NaNO}_3$ ) is prepared at  $80^\circ\text{C}$ , calculate how much sodium nitrate will settle out if the solution is cooled to  $10^\circ\text{C}$ .

$$\begin{array}{l} \text{at } 80^\circ\text{C} \\ 147\text{g}/100\text{g H}_2\text{O} \end{array} \quad \begin{array}{l} \text{at } 10^\circ\text{C} \\ 78\text{g}/100\text{g H}_2\text{O} \end{array} \quad 147 - 78\text{g} = 69\text{g}/100\text{g H}_2\text{O}$$

So  $\therefore$   $138\text{g}/200\text{g H}_2\text{O}$

- b) 10 g of Ammonium chloride ( $\text{NH}_4\text{Cl}$ ) is prepared in 25 ml of water at  $50^\circ\text{C}$ . State and explain whether the solution would be saturated, supersaturated, or unsaturated.

$$\begin{array}{l} \text{at } 50^\circ\text{C} \\ 51\text{g} \\ \hline 100\text{g H}_2\text{O} \end{array} = \frac{x}{25\text{g H}_2\text{O}}$$

$x = 12.75\text{g} \leftarrow \text{max amt.}$

- c) State what happens to the solubility of a gas as the temperature of the solution increases. Explain why at the molecular level.

as temp  $\uparrow$ , sol.  $\downarrow$   $\rightarrow$  gases need to make bonds which requires energy to be removed

## Physical Properties of Matter

1. At sea level and under standard temperature and pressure conditions, water will boil at  $100^{\circ}\text{C}$  while ethanol will boil at  $78^{\circ}\text{C}$ . State which of the two has the **higher** vapour pressure and explain why.

Answer: ethanol

### Explanation

molecules of ethanol escape more easily so will create  
more vapour

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2. List two factors that affect the rate of evaporation.

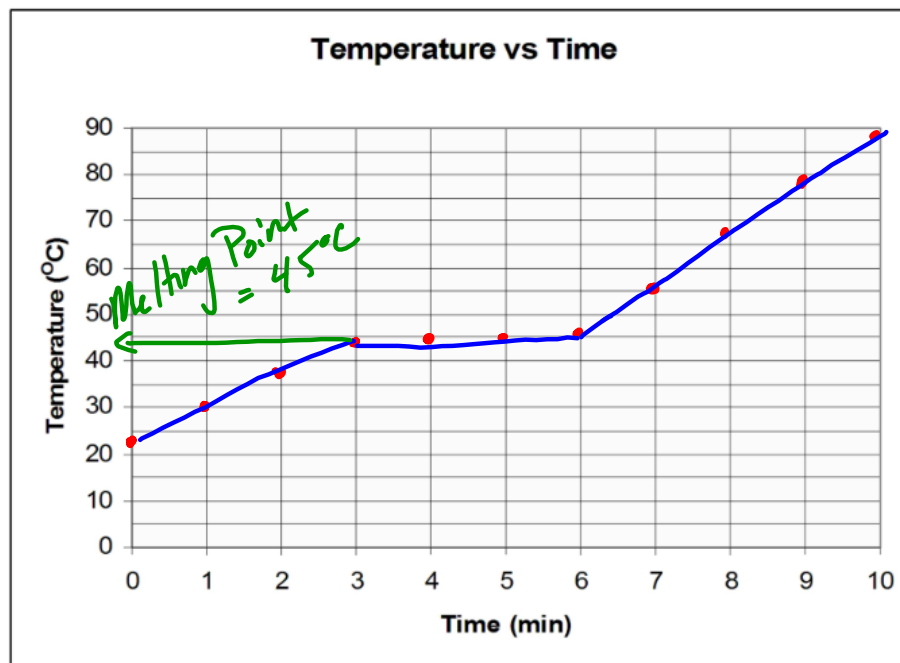
Factor #1:

Surface Area, temp, IMF's, Pressure

Factor #2:

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3. The following data were collected upon heating Lauric Acid:
- Plot and graph the data on the grid below.
  - Label the melting point on the graph



- c) Explain at the molecular level, why the temperature is not changing significantly from 3 – 6 minutes.

energy is being used to break IMF's as it melts

## Gases and the Atmosphere

1. Describe the contribution made by one of the following chemists in the measurement of pressure:

John Dalton

Joseph Louis Gay-Lussac

Amadeo Avogadro

*See notes*

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2. A syringe containing a sample of gas is heated from 100 K and the following data were collected.

Temperature (K)	Volume (ml)
100	8.75
200	17.45
300	26.17
400	34.89

- a) Based on the data, describe the relationship that exists between the temperature and the volume of the gas.

Direct  $\rightarrow$  as temp  $\uparrow$ , Volume  $\uparrow$

- b) Explain what happens to the gas particles when they are heated.

particles speed up, spread out, & push out on container more

- c) If the gas was heated to 427 °C, what volume would this gas occupy?

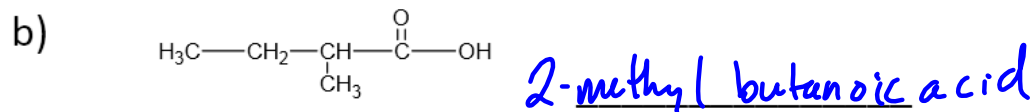
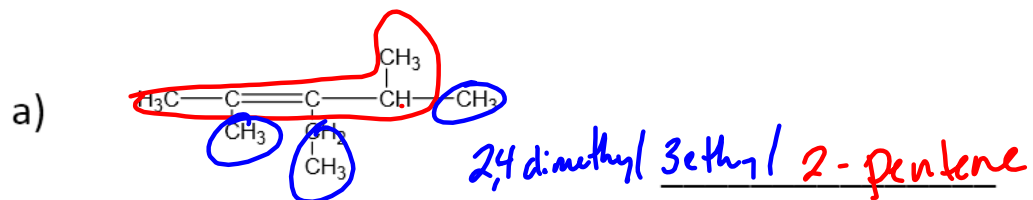
$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$8.75 \text{ ml} \times \frac{700 \text{ K}}{100 \text{ K}} = 61.25 \text{ mL}$$

$$427^\circ\text{C} = 700\text{K}$$

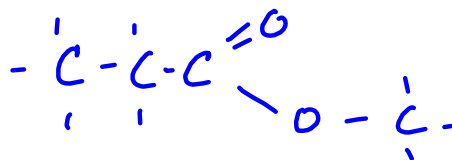
## Organic Chemistry

1. Write the name for the following organic compounds.

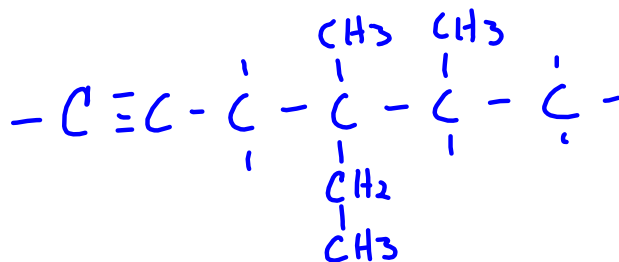


2. Draw the molecule for the following organic compounds in the space provided:

a) Methyl Propanoate

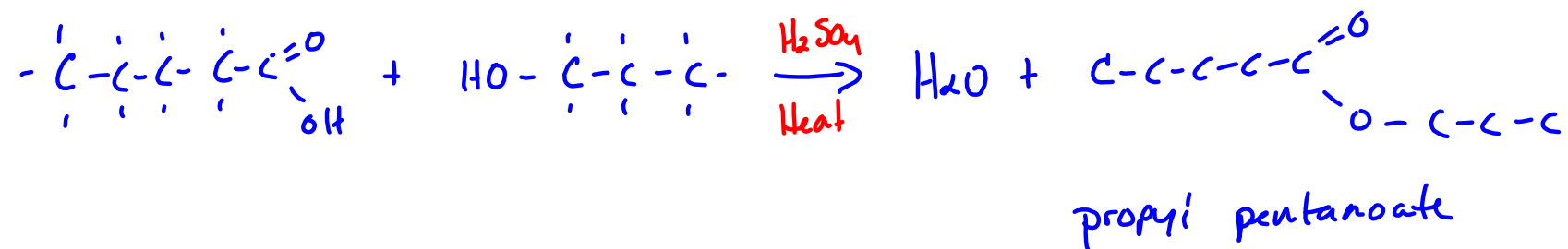


b) 4-ethyl-4,5-dimethyl-hex-1-yne



## Organic Chemistry

1. Draw the reaction, showing structures, for the reaction between pentanoic acid and 1-propanol. Be sure to show all conditions necessary for the reaction to take place (catalyst, etc.) and name the products.



2. Name and draw all the structural isomers of pentane  $C_5H_{12}$ .

